

The Significance of Nutrition on Patients initiated on Antiretroviral Therapy at Gelukspan District Hospital

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An assignment presented in partial fulfilment of the requirements for the degree of Master of Philosophy (HIV/ AIDS Management) at Stellenbosch University

Declaration

By submitting this assignment electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

22 February 2010

Abstract

In our setting, Gelukspan district hospital situated in the North West province of South Africa, it is not routine that patients initiated on antiretroviral therapy are referred to a dietitian for a diet prescription and nutrition advice. There are no protocols that exist for referral of patients initiated on antiretroviral therapy to a dietitian. In the study medical records of 194 patients initiated on antiretroviral therapy were randomly selected. Half of them were referred to the dietitian and they were matched with the other half that was not referred. The body mass indexes of both groups were calculated at the beginning of the study period and at the end and then the difference determined. It was noted that the body mass index difference for those that were referred to the dietitian was significantly greater than those that were not referred. This means that it is important to refer patients initiated on antiretroviral therapy to a dietitian in order to improve their nutrition status and recovery of their health.

Opsomming

Waar ons ons bevind, hier by die Gelukspan-distrikshospitaal in Suid-Afrika se Noordwes provinsie, is dit nie roetine dat pasiënte, wat met antiretrovirale terapie begin het, na 'n dieetkundige verwys word vir 'n dieetvoorskrif en advies oor voeding nie. Daar bestaan ook geen protokol vir die verwysing van pasiënte, wat met antiretrovirale terapie begin het, na 'n dieetkundige nie. Vir doeleindes van dié studie is die mediese rekords van 194 pasiënte, wat met antiretrovirale terapie begin het, na willekeur gekies. Die helfte van hulle is na 'n dieetkundige verwys en hulle is met die ander helfte, wat nie verwys is nie, vergelyk. Die liggaamsmassa-indeks van albei groepe is aan die begin en aan die einde van die studietydperk bereken en die verskil is onmiddellik daarna bepaal. Daar is bevind dat die liggaamsmassa-indeks van diegene, wat na die dieetkundige verwys is, beduidend groter was as hulle wat nie verwys is nie. Dit dui daarop dat dit belangrik is om pasiënte, wat begin het met antiretrovirale terapie, na 'n dieetkundige te verwys sodat hulle voedingstatus en gesondheidsherstel verbeter kan word.

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List of Abbreviations

ANOVA	Analysis of Variance
AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
ARVs	Antiretroviral Drugs
BMI	Body Mass Index
HSRC	Human Sciences Research Council
OI	Opportunistic Infections
PLWHA	People Living With HIV/AIDS

List of Definitions

Adherence to treatment.

Adherence is the extent to which a patient follows a treatment regime which has been designed in the context of a consultative partnership between the client and the health care worker/counsellor.

ANOVA.

ANOVA is a technique of for analysing the way in which the mean of a variable is affected by different types and combinations of factors. One-way analysis of variance is the simplest form. It is an extension of the student t-test and can be used to compare any number of groups of treatments.

Body Mass Index.

Body mass index is the weight of an individual (in kilograms) divided by the height (in metres squared).

CD4 Count.

CD4 cell count is a key measure of the health of the immune system. CD4 cells are a type of white blood cells in the body that fight disease. The lower the CD4 cell count th the body the greater the damage to the immune system HIV has done.

Mann-Whitney test.

The Mann-Whitney test is sometimes used to compare the efficacy of two treatments in clinical trials. It is often presented as an alternative to the t-test when the data is not normally distributed. It is a test of population medians.

Opportunistic Infections.

Opportunistic infections are infections that occur as a result of a weak immune system. Such infections include tuberculosis.

Student t-test.

A student t-test is statistical test used to compare two small sets of quantitative data when samples are collected independently of each other. It is used to test the hypothesis on the basis of a difference between sample means.

The normal probability plot.

This is a graphical technique for assessing whether or not a data set is approximately normally distributed.

The Spearman rank correlation analysis.

The Spearman rank correlation analysis is used when there are two measurement variables for example height and weight. The analysis is used to see whether the measurement variables co vary, for example when one variable increases the other tend to increase or decrease. It is used when the data do not meet the assumption about normality.

Variables.

Variables are different classes of information for example age, gender, weight, height, marital status. Variables can be divided into independent and dependent variables. Independent variables are those that are experimentally manipulated by an investigator and dependent variables are those that can be measured.

1. Introduction

1.1. Background

In our rural hospital setting, Guluksan district hospital, there is no regular referral of patients to a dietician resulting in many HIV positive patients being on antiretroviral therapy with no nutritional support. There are no protocols that exist with regard to referral of patients to a dietician. Patients are referred at the discretion of the health care worker, which results in many patients that require nutrition support not being assessed by a dietician.

It is a fact that antiretroviral therapy alone is not adequate to treat patients with HIV/AIDS. It is important to assess the nutrition status of these patients. Assessment of the nutrition status of these patients can be done by a dietician who can also give advice and prescribe a diet that will help improve their BMI and reduce morbidity and mortality.

1.2. Aim

The aim of the study is to investigate whether the nutrition status of HIV/AIDS patients initiated on ART and are referred to a dietician is better than those that are initiated on ART but not referred.

1.3. Literature study

HIV/AIDS continues to be a major global health priority. Although some important progress has been achieved in preventing new HIV infections and in lowering annual number of AIDS related deaths, the number of people living with HIV continues to rise. Sub-Saharan Africa remains the most heavily affected region accounting for 71% of all new HIV infections. (UNAIDS, 2009).

Sub-Saharan Africa, the region that carries two thirds of the global HIV/AIDS burden, is also one of the poorest regions in the world. Poverty in this region is associated with poor food intake and vulnerability to other infectious diseases such as tuberculosis and malaria. Poor food intake results in malnutrition.

Malnutrition takes many forms. These include; protein energy malnutrition, which is usually measured in terms of body size, and micronutrient malnutrition, which in its mild and moderate forms is not always recognised and is often referred to as "hidden hunger". Common indices of protein energy malnutrition are low height for age (stunting), low weight for age (underweight), and low weight for height also known as acute malnutrition in children and low Body Mass Index (BMI) in adults. The most commonly reported micronutrient deficiencies in both children and adults are iron, vitamin A, and iodine deficiency.

Deficiencies in other vitamins and minerals that are vital for the body's normal function, including the work of the immune system are not commonly measured but frequently occur in populations with high infectious disease burdens and monotonous poor diets characterised by limited consumption of animal products and seasonal or periodic food insecurity. The relationship between HIV and nutrition is complicated because the virus directly attacks and destroys the cells of the immune system. Nutritional deficiencies affect immune function in ways that may influence viral expression and replication, further affecting HIV disease progression and mortality. (Piwoz E.G and Preble, E, A, 2000).

As it has been noted malnutrition in patients with HIV/AIDS is associated with immune suppression, morbidity and mortality.. Even weight loss of 5 per cent is associated with increased morbidity and mortality (Wilson, D et al 2005).

Malnutrition in people living with HIV/AIDS (PLWHA) is exacerbated by the fact that energy intake in PLWHA increases by 10% in asymptomatic patients and 20-30% in those that are symptomatic even when they are on antiretroviral therapy (ART). (Coghil, B, 2005).

The introduction of ART in resource poor countries in recent years has improved the lives of many PLWHA. A study conducted in Boston and Providence, Rhode Island found that several vitamin and mineral deficiencies noted as common before the wide spread use of antiretroviral drugs, were less common in patients on antiretroviral therapy. (Thaczuk, D, 2006).

Antiretroviral coverage has been on the increase globally. ART coverage rose from 7% in 2003 to 42% in 2008 with especially high coverage achieved in eastern and southern Africa (48%). As of December 2008, approximately 4 million people in low- and middle - income countries were receiving antiretroviral therapy. A 10 fold increase over 5 years. (UNAIDS, 2009).

In an effort to increase ART coverage in South Africa the South African government published the National Antiretroviral Treatment Guidelines in 2005 which stipulate that patients with HIV/AIDS with CD4 count less than 200 or they have a WHO clinical stage 4 disease are eligible for ART¹. It is important to start patients on ART as soon as possible before their CD4 count drops to levels so low that their immune system will be severely destroyed making it difficult for it to recover.

As more and more people are introduced to ART in resource poor settings more attention need to be paid to whether a person's nutrition status could impact on the success of treatment. (Smart, T, 2005).

While it is evident that the introduction of ART has improved the health of many PLWHA it should be noted that ART alone is not adequate. PLWHA also require good nutrition. PLWHA require protein with a balanced diet to maintain the body's response to infection and its ability to process medications. (Fields-Gardner, C, undated).

ART and food can have a significant impact on the nutritional status, efficacy of medication and the quality of life of PLWHA. (Downer, G, A, 2007). Evidence is emerging that people on ART receiving food supplements recover much faster. Better food and nutrition makes ART more effective. (UNGA SS, 2006).

¹. In a speech presented by the South African president on the 2009 World AIDS Day the South African government intends to increase ART coverage starting from 1st April 2010 by giving treatment to all HIV positive children less than 1 year old regardless of their CD4 count.

All HIV positive patients infected with TB with CD4 count less than 350 will get ART and all pregnant women who are HIV positive with CD4 count less than 350 will get treatment.

Source: www.infor.gov.za/speeches/2009/09120112151001.htm

Antiretroviral medications interact with food in many different ways. Some need to be taken on empty stomachs for them to be effective. Some have to be taken on a full stomach. In some PLWHA, underlying malnutrition and poor dietary intake influence plasma levels of ART drugs. In addition there are interactions between certain dietary substances and plasma ART medication levels. Some food supplements such as long-term use of garlic has been found to reduce the efficacy of some ART drugs. (Tomkins, A, M, 2005).

ART drugs are strong and people on treatment need food in order for them to be able to tolerate these drugs. In eastern Uganda it was reported that patients on ART stopped taking their ARVs because they made them weak and they felt like vomiting. This situation arose as a result of the lack of food in the region due to drought. (PlusNews, August 2009). In Haiti PLWHA are more desperate for food than ARVs. Patients are too weak to work but when they start taking ARVs they become stronger but have no money to buy food and they feel unwell after taking their treatment without food. (Walker, R, 2008). Patients on ARVs in Mozambique are abandoning their ARVs because of nausea and weakness due to taking these drugs on an empty stomach. This is because patients are too weak to work and put food on the table. (Landis, R, 2009).

In order to assess the nutritional status of adults, there are indices such as those of Broca, Lorentz and others. Every index has its own value but the comparison between available data is difficult. To assess the nutrition status of adults, the WHO recommends the use of the body mass index (BMI). (Giay, T & Khoi H, undated).

BMI, which is weight in kilograms divided by height in meters squared, allows health care workers to assess the nutritional status of a patient at a single point in time. This eliminates reliance on weight changes over time. With height basically fixed at the age 20 years, changes in BMI are a reflection mainly of changes in weight. (Wittenberg, M. 2005). BMI has become the most commonly used index of body composition in epidemiology research. It has displaced weight, height, and other measures of body composition (Bagust, A & Walley, T, 2000). In people living with HIV/AIDS a BMI of less than 18, 5% is associated with high mortality risk. BMI is also known as a quetelet index (Merriam-Webster Medical Dictionary, 2010). It can also be determined by using a BMI chart². This chart displays BMI as a function of weight (horizontal axis) and height (vertical axis) using contour lines for different values for BMI or colour for different BMI categories.

A dietician is a trained member of a health care team who understands the importance of nutrition in the management of patients. The dietician prescribes a specific diet for individual patients depending on their general state of health. A dietician and nutritionist should be qualified in dietetics, food and nutrition, and food service systems management. Dieticians plan food and nutrition programmes, supervise meal preparations, and oversee the serving of meals. They prevent and treat illnesses by promoting healthy eating habits and recommending dietary modification, for example dieticians might teach a patient with hypertension how to use less salt when preparing meals, or create a diet reduced in fat and sugar for an overweight patient. (U.S. Department of Labour, 2009).

². See Appendix A

In summary a comprehensive care plan for people living with HIV/AIDS should include good nutrition and antiretroviral therapy. In order to prevent morbidity and mortality in PLWHA initiated on ART it is important to refer all these patients to a dietician for a diet prescription and nutrition advice.

1.4 Objectives

The objectives of the research study are:

- to determine whether there is an improvement in the BMI of patients initiated on antiretroviral therapy that are referred to a dietician,
- to recruit patients for the study and divide them into two groups. One group will be those that were referred to a dietician and the other those that were not. The BMI of the two groups of patients will be compared at the beginning of the study period and at the end.
- In order to determine whether the nutrition status of those referred to a dietician is better than those not referred and to determine whether it is important to refer all patients initiated on antiretroviral therapy to a dietician.

2. The Research Problem

From the literature study, it was deduced that patients that have HIV/AIDS require antiretroviral drugs depending on the stage of the disease and their CD4 count. These patients also require a balanced diet to improve their health and productivity.

As mentioned, in our setting it is not routine that HIV/AIDS patients that are initiated on antiretroviral therapy are referred to a dietician. There is no protocol that guides this process. It is purely done by the discretion of the health care worker. This begs the question: What is the relationship between the nutrition status of patients referred to dietician and those not referred? In other words, does referring HIV positive patients initiated on antiretroviral therapy to a dietician improve their health outcome (as determined by their BMI)?

3. Hypothesis

The null hypothesis that is being tested is that referral of HIV/AIDS patients initiated on antiretroviral therapy to a dietician does not improve their recovery as determined by their BMI.

4. Research Methodology

4.1. Research Design

The research design that was used to test the hypothesis was the between participants post-test only design.

This research design was chosen because research participants were randomly assigned to the control group, which is the group that was not referred to the dietician, and the experimental group, that is the group that was referred.

4.2. Sampling

In the study period it was noted that fewer patients were referred to the dietician than those that were not. Because of this all those who were referred to the dietician at least once were included in the study. There were, however, a larger number of patients that qualified to be included in the study but were not referred to the dietician.

The group that was not referred to the dietician, since it was large, was randomly selected by using a list of random numbers and this group was then matched with the group that was referred.

4.3. Data Collection

For practical purposes medical records of participants were selected from Gelukspan district hospital wellness clinic. This ensured that participants had similar socio-economic background since they come from the same catchment area. The same socio-economic background ensures that the diets of the people in the study were similar.

Patients referred to a dietician at Gelukspan district hospital had a dietician referral form completed by a health care worker for example a doctor or a nurse.

Permission to conduct the study was obtained from the hospital clinical manager and the project manager of the wellness clinic at Gelukspan district hospital.

Data was collected using the data collection sheet³.

Information on two groups of HIV/AIDS patients initiated on antiretroviral therapy was obtained by looking at their medical records in retrospect. The two groups are those that were referred to the dietician and those that were not. Information was obtained from medical records of patients who were initiated on ART in the period starting January 2008 and ending December 2008.

The medical records that were looked at include the medical notes made by the attending doctor, the ART initiation form⁴, and the dietician referral form⁵.

Information that was obtained from the medical records included; age, sex, baseline CD4 count, baseline height and weight, end of study weight, history of opportunistic infections, and whether or not the patient was referred to a dietician.

³. See Appendix B

⁴. See Appendix C

⁵. See Appendix D

Patients that were excluded from the study are those that were initiated on ART before or after the study period, those with CD4 count more than 200, children, pregnant women, those who defaulted treatment, those that were transferred in from other ART sites, those that were transferred out to other ART sites during the study period, and those who were very ill at initiation of ART such that they were not able to stand to have their weight and height measured.

The patients that had CD4 cell counts more than 200 were excluded because they were not considered to have AIDS. These patients were unlikely to have been initiated on ART unless they had stage 4 HIV disease according to the South African National Antiretroviral Treatment Guidelines of 2005.

Adherence to treatment is a critical factor in successful control of any infection. Non adherence places at risk the health of the individual, their family, and the wide community, as well as wasting health resources. (Mc Leon, M, 2003). Adherence empowers the patient to decide when it is appropriate for them to take their medication without defaulting.

In an effort to ensure that all the patients in the study were benefiting from ART, those who defaulted on treatment were not included. Defaulting meant those patients who missed their appointments and did not collect their drugs at the scheduled date.

Pregnant women were excluded from the study because of their weight, which changes constantly because of the pregnancy. Children were not included in the study because they are constantly growing. This would have made it difficult to calculate their BMI and attribute it to ART, diet or the natural growth process.

Those patients who were transferred in from other HIV treatment sites were not included in the study because they came in from different socio-economic backgrounds.

The body mass indices of the two groups were calculated at the beginning of the study and then at the end using a body mass index calculator. Improvement of patients was observed by calculating the BMI of the patients at initiation of ART and then at the end of the study period. The difference in BMI was compared between those that were referred to the dietician and those that were not.

The medical records from which information was obtained were marked with an X to make sure that the same file was not looked at more than once.

Patients referred to a dietician at Gelukspan district hospital had a dietician referral form completed by a health care worker for example a doctor or a nurse.

5. Results

The study was conducted in a district hospital that serves mostly a rural population most of whom depend on social grants and money sent to them by relatives who work in large cities for survival.

There were 507 patients initiated on ART at Gelukspan district hospital wellness clinic in the period between January to December of 2008. Of these 126 were referred to a dietician, which is 24.8% of ART initiates.

Normal probability plots were plotted to determine whether the data were normally distributed. The results showed that the data were not normally distributed and for this reason non-parametric statistical tests such as the Mann-Whitney test were appropriate to use to analyse the data. However, parametric test, for example the ANOVA and the t-test were also used to test the hypothesis. This was done to compare the parametric and the non-parametric tests in testing the hypothesis. Both groups of tests rejected the null hypothesis.

In the study, of those that were referred to a dietician, 50 were underweight, 39 had normal weight, 8 were overweight and there was no one who had obesity.

Of those that were not referred to dietician, 33 were underweight, 48 had normal weight, 14 were overweight and 2 were obese ⁶.

After statistical analysis, variables were presented graphically in forms of histograms to determine the nature of their distribution and to be able to identify any outliers.

A t-test for independent samples was used on the BMI difference means of the two groups to determine whether there was any significant difference between them. The results show that there was a significant difference between the means. The mean of the BMI difference of those that were referred to the dietician was greater than those that were not. This is also shown in the Box and Whisker plot for BMI difference as displayed in figure 5.3.

The influence of the number of times an individual visited the dietician, age, and the baseline CD4 count on the BMI difference were computed using the Spearman correlation test.

The results of the data analysis show that the number of times an individual visited the dietician was correlated with a better recovery in the nutrition status based on the BMI difference, which is the difference between the initial BMI and the end BMI. The reason for this could be that those patients who visited the dietician several times had the information on nutrition repeated to them many times such that they remembered it and applied it in their daily living. It is also possible that those who visited the dietician received food parcels at each visit and had a more nutritious diet than those that visited the dietician fewer times or not at all.

The results of the analysis of age and BMI difference showed that age did not have a significant influence on the BMI difference for all groups. This was also true for those that were referred to the dietician and those that were not.

⁶. See Appendix E

Analysis of the data showed that the baseline CD4 count at initiation of ART did not have a significant influence on the BMI difference for all groups, the group referred to the dietician and those that were not referred.

To determine the influence of referral to a dietician on the BMI at the beginning and at the end of the study period the repeated measure of the analysis of variance (ANOVA) was computed.

ANOVA was also used to determine whether gender and opportunistic infections had any influence on the BMI difference.

Patients that had opportunistic infections showed a significant improvement in their BMI. This was seen when the initial BMI was compared with the end BMI in these patients. This can be attributed to the fact that patients that had opportunistic infections had very low BMI at the beginning of the study due to the opportunistic infection and HIV/AIDS. When the opportunistic infection was treated and ART was initiated there was a significant improvement in the BMI.

There were 74% women and 26% men. In the study the smaller number of men included can also be attributed to the fact that there are fewer males attending the wellness clinic than females, therefore, few men were likely to be selected for inclusion. The results of the analysis show that gender had no significant influence on BMI difference for all groups, those referred to the dietician and those not referred.

Table 5.1

T-test for independent samples (groups)

T-tests; Grouping: DIETITIAN (DATA20091005.sta)

Variable	T-tests; Grouping: DIETITIAN (DATA20091005.sta)								
	Group 1: REFERRED								
	Group 2: NOT REFERRED								
	Mean	Mean	t-value	df	p	Valid N	Valid N	Std.Dev.	
	REFERRED	NOT REFERRED				REFERRED	NOT REFERRED	REFERRED	NOT REFERRED
BMI DIFF	2.879381	1.912371	2.260712	192	0.024899	97	97	3.300566	

Table 5.1 shows that the calculated t value is 2.26. This is greater than the p value of 0.024 at 192 degrees of freedom.

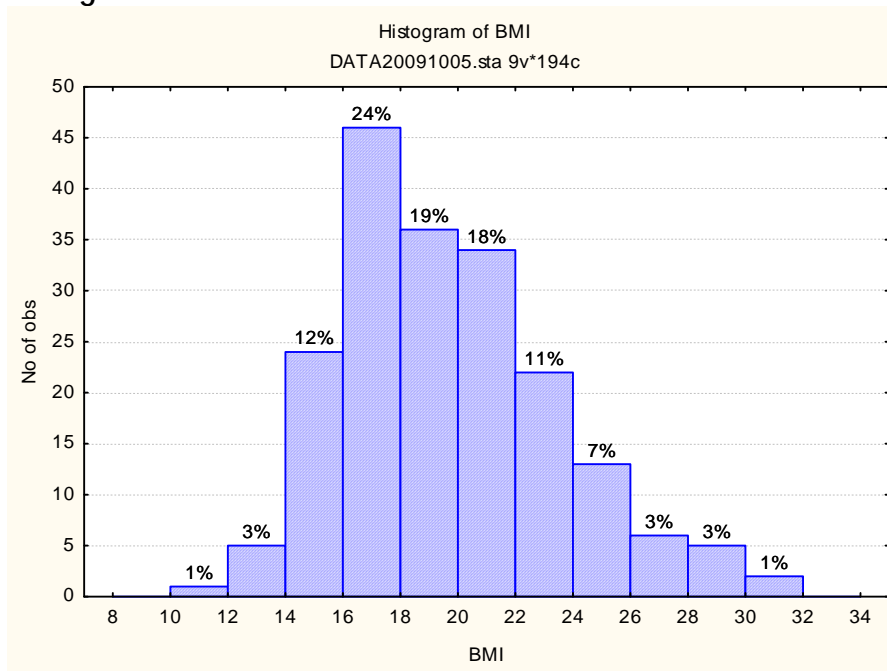
The calculated t value of 2.26 is also greater than critical value of 1.96 obtained from the critical values of t at infinity degrees of freedom and significance level for two-tailed test of $p < 0.05$.

The t-test shows that the difference between the two means is less than 5% due to chance.

This, therefore, means that the difference between the two means, that is the means of BMI difference of those that were referred and those that were not referred to a dietician, is significant.

Figure 5.1

Histogram of BMI



The histogram in figure 5.1 shows the initial BMI of both groups. That is those that were referred and those that were not referred to a dietician.

The figure shows that 24% of patients had a BMI of between 16 and 18. A total of 40% had BMI less than or equal to 18.

Forty eight percent of patients had normal weight, that is BMI between 18 to 24, and 13% were overweight.

One percent of patients were obese. There were no individuals that were severely overweight.

Figure 5.2

Histogram of END BMI

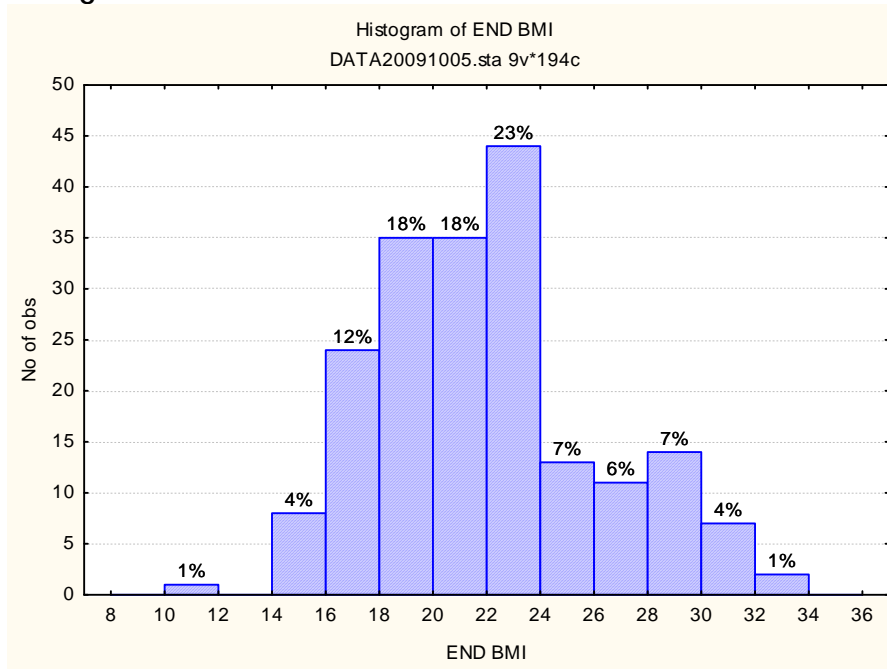


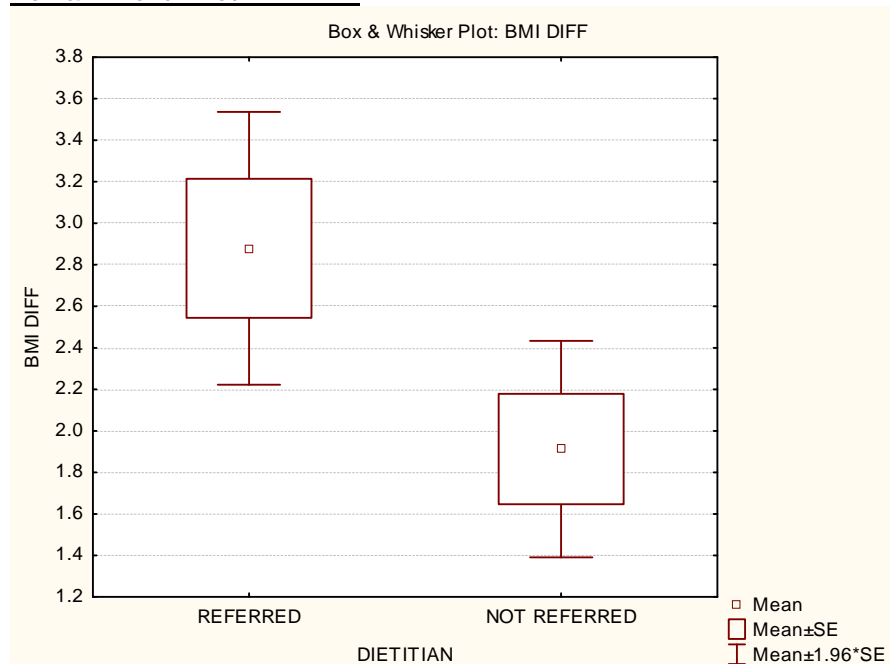
Figure 5.2 shows BMI of both groups at the end of the study period. At the end of the period all patients were on ART and some were referred to the dietician and some were not.

It can be noted that the total number of patients with BMI less than 18 has decreased from 40% at the start of the period to 17%. The number of individuals with normal BMI, that is BMI between 18 and 24, has increased from 48% at beginning of the period to 59% at the end.

Twenty percent of the patients were overweight and 5% were obese

Figure 5.3

Box & Whisker Plot: BMI DIFF



The Box and Whisker Plot represent means shown by small boxes inside the big box, the big box represents the median interquartile range with vertical lines showing the range. (Bewick, V et al, 2004).

Figure 5.3 shows that plotting the BMI difference of the two groups on the Box and Whisker plot clearly show that there was a difference between those that were referred to a dietitian and those that were not. Those that were referred had higher mean BMI difference than those that were not.

Table 5.2

ANOVA Results 1: DATA20091005.sta

Repeated Measures Analysis of Variance (DATA20091005.sta)

Repeated Measures Analysis of Variance (DATA20091005. Sigma-restricted parameterization Effective hypothesis decomposition					
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	169800.1	1	169800.1	6612.419	0.000000
DIETITIAN	303.2	1	303.2	11.808	0.000723
Error	4930.4	192	25.7		
REPEAT	544.9	1	544.9	122.884	0.000000
REPEAT*DIETITIAN	22.4	1	22.4	5.049	0.025781
Error	851.4	192	4.4		

The data in table 5.2 shows the p value of 0.025781, which is less than $p < 0.05$. This implies that the means between the two groups differ significantly.

The table shows the calculated F value of 5.049 and p-value of 0.025781.

Figure 5.4

REPEAT*DIETITIAN; LS Means

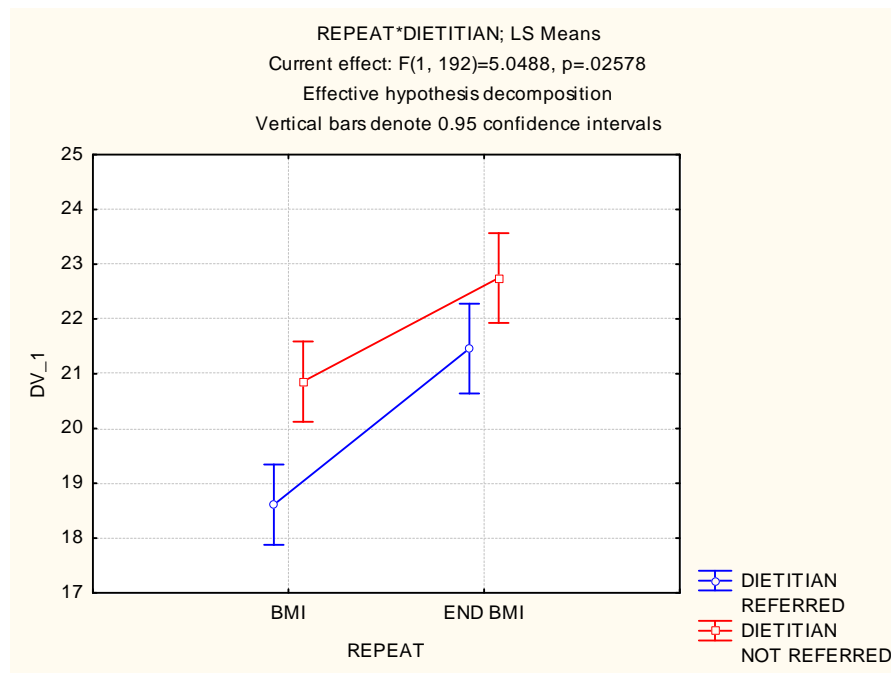


Figure 5.4 shows the analysis of the means of initial BMI and end BMI between those that were referred to the dietitian and those that were not.

ANOVA was used to investigate if the means of BMI difference differed significantly between those that were referred to the dietitian and those that were not referred.

Assuming the data was normally distributed the ANOVA F test gave a p- value of 0.026. The p-value of the test is less than the significance level of $\alpha = 0.05$. This indicates that the mean BMI difference in the two groups differed significantly.

Figure 5.5

Bootstrap

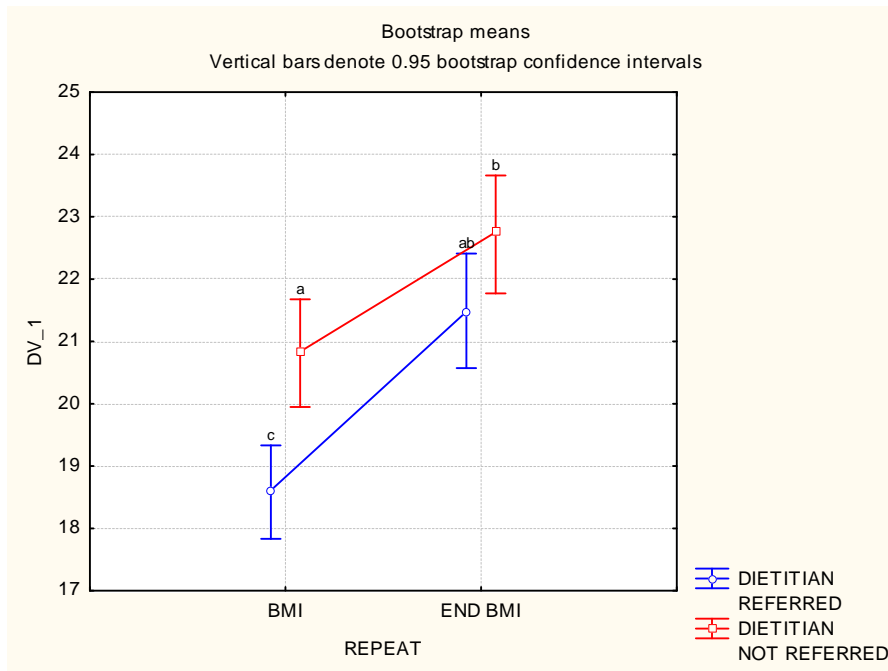


Figure 5.5 represents a graphical presentation of the bootstrap means of those patients referred to the dietitian and those that were not.

A bootstrap mean is calculated by generating an artificial data set by randomly sampling the original data set. A trimmed mean is then calculated for each of the artificial data set. These steps are repeated many times to produce a set of trimmed means.

The bootstrap mean is the average of these trimmed means. The bootstrap mean is a more robust estimate of the true mean and the estimation of error is the usual standard deviation. (Lam, C, K, 1993).

In figure 5.5 above, the bootstrap means for the two groups show that those that were referred to the dietitian had a greater difference between the initial BMI and the end BMI than those that were not referred.

Figure 5.6
Normal Prob. Plot; Raw Residuals

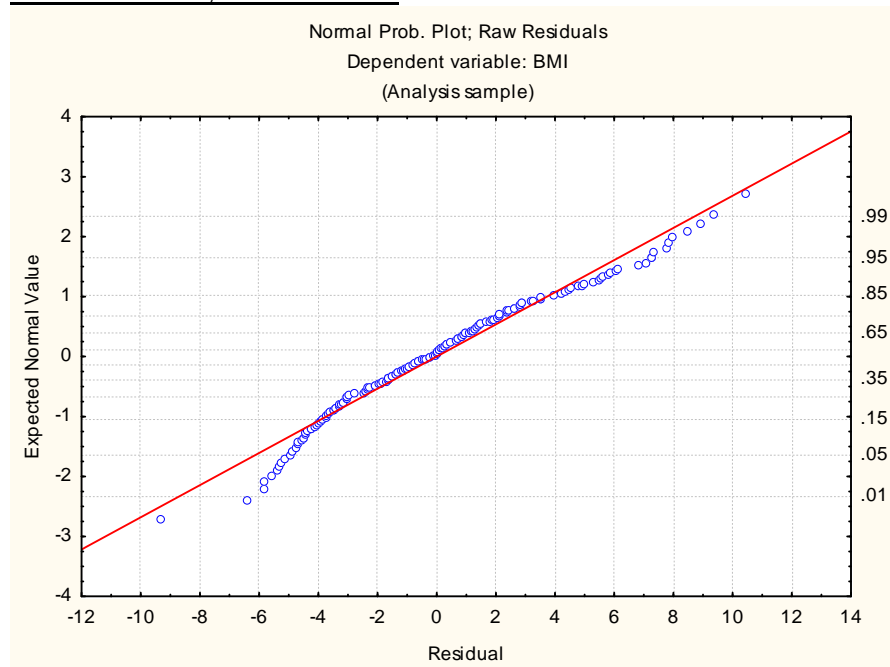


Figure 5.6 shows the normal probability plots of the residues to determine whether the data for initial BMI is normally distributed.

The dots in the graph can be seen to deviate a lot from the straight line especially at the bottom; therefore the assumption that the data is normally distributed cannot be made.

Figure 5.7
Normal Prob. Plot; Raw Residuals

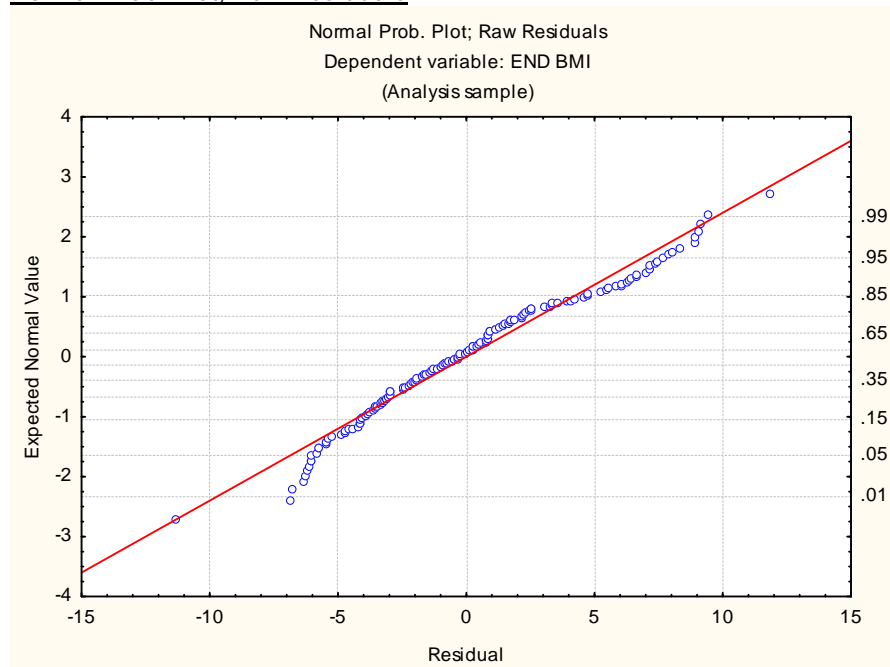


Figure 5.7 shows the normal probability plots of the residues to determine whether the data for end BMI is normally distributed.

The dots deviate quite a lot from the solid line. This implies that the data is not normally distributed.

In this case a non-parametric test, the Mann-Whitney test is more appropriate.

Table 5.3

Mann-Whitney U Test (DATA20091005.sta)

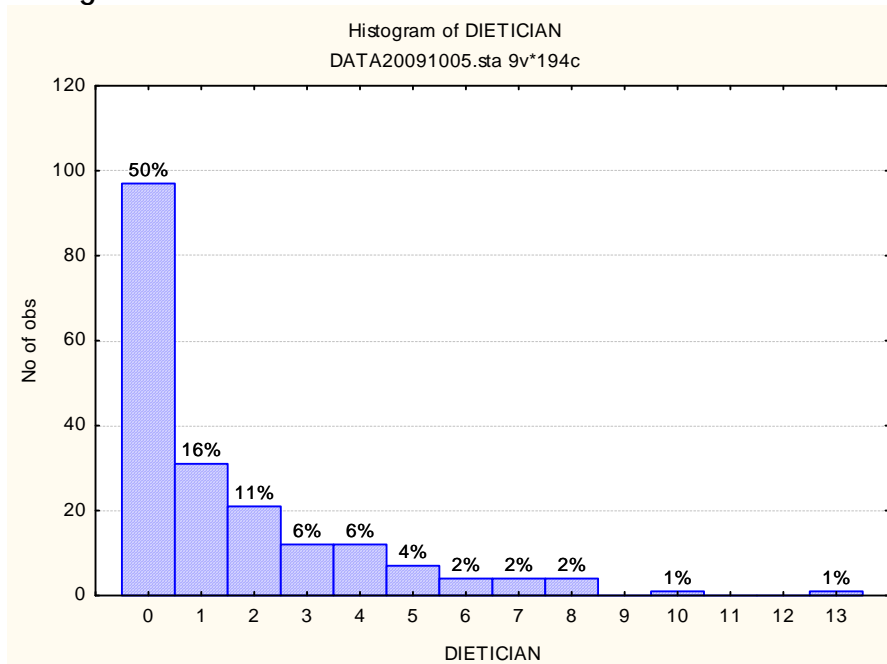
Mann-Whitney U Test (DATA20091005.sta)							
By variable DIETITIAN							
Marked tests are significant at p < .05000							
variable	Rank Sum REFERRED	Rank Sum NOT REFERRED	U	Z adjusted	p-value	Valid N REFERRED	Valid N NOT REFERRED
BMI DIFF	10353.50	8561.500	3808.500	2.290411	0.021998	97	97

Table 5.3 shows the Mann-Whitney test.

The Mann-Whitney test shows a p value of 0.02 which is less than $\alpha=0.05$. This implies that there is a significant difference between the two means as it was seen when the analysis of variance was done

Figure 5.8

Histogram of DIETITIAN



The influence of the number of times an individual visited the dietitian on the end BMI was computed.

Figure 5.8, above, shows the number of times each individual in the two groups visited the dietitian. As shown, 50% of patients in the study did not visit the dietitian.
Figure 5.9

Histogram of DIETITIAN

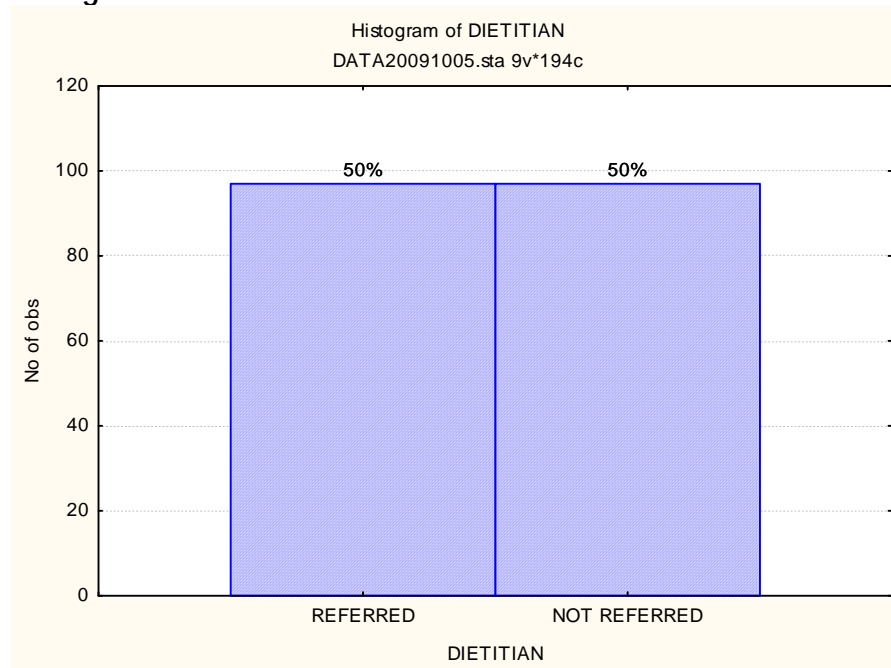


Figure 5.9 shows percentages of those patients in the study that were referred to the dietitian and those that were not.

The figure also shows that 50% of the patients in the study were not referred to a dietitian.

Figure 5.10

BMI DIFF (Interpret the Spearman correlation test)

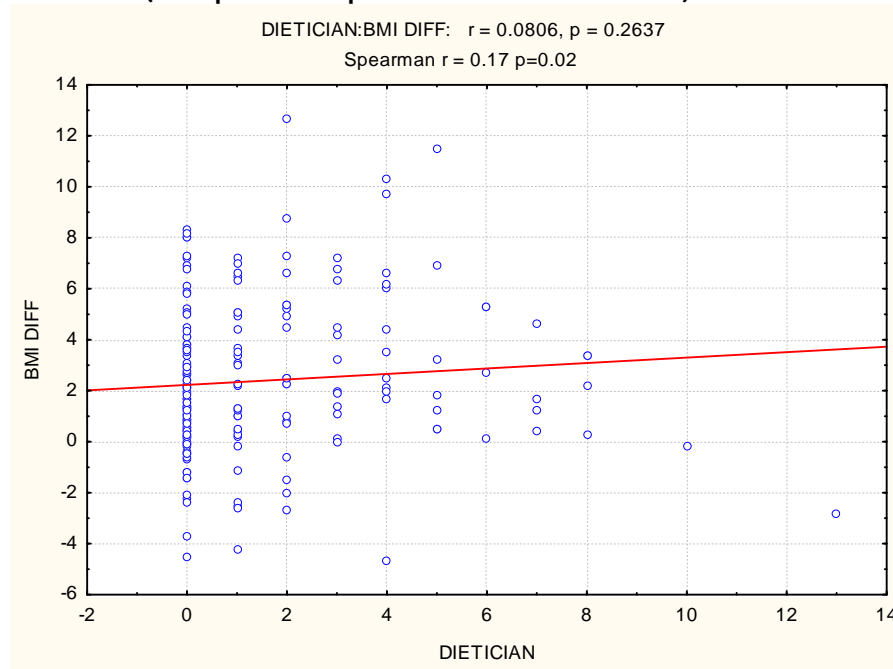


Figure 5.10 shows the Spearman rank correlation analysis that was conducted to determine whether the number of times an individual visited the dietitian had any influence on the difference between the initial BMI and the end BMI.

The analysis showed that the number of visits to a dietitian had a significant influence on the BMI difference, $r = 0.17$, $p = 0.02$, $p < 0.05$.

This means that the more the number of times an individual visited the dietitian the better their nutrition outcome as seen by the difference between the initial BMI and the end BMI.

Figure 5.11

Histogram of OI

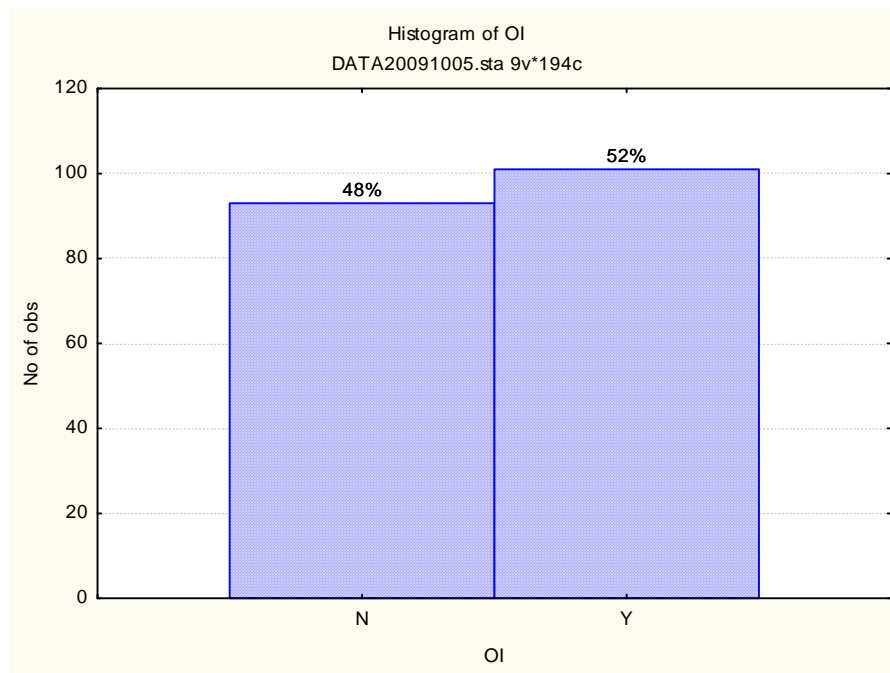


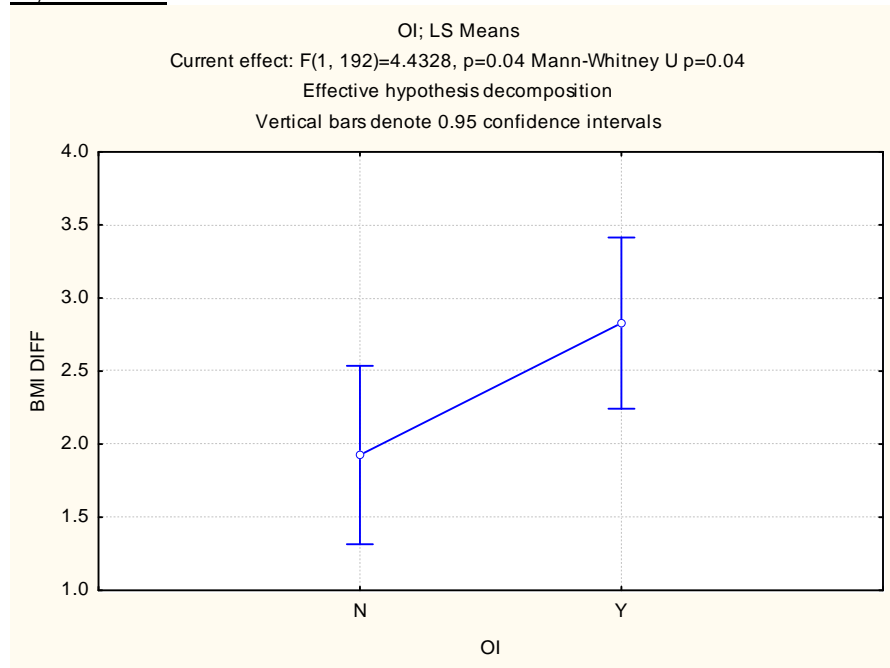
Figure 5.11 shows the percentage of patients that had opportunistic infections in the study.

Opportunistic infections are a common occurrence in people living with HIV/AIDS. In the study 52% of patients had opportunistic infections.

Figure 5.12

BMI DIFF OI

OI; LS Means



The influence of opportunistic infections on the BMI difference was computed using the Mann-Whitney test and ANOVA. Both tests showed that there is a significant influence of opportunistic infections on the BMI difference, $p=0.04$, $p<0.05$ and $F(1, 19) = 4.43$, $p = 0.04$ at $p<0.05$ respectively. See figure 5.12 above.

Table 5.4

Descriptive Statistics (DATA20091005.sta)

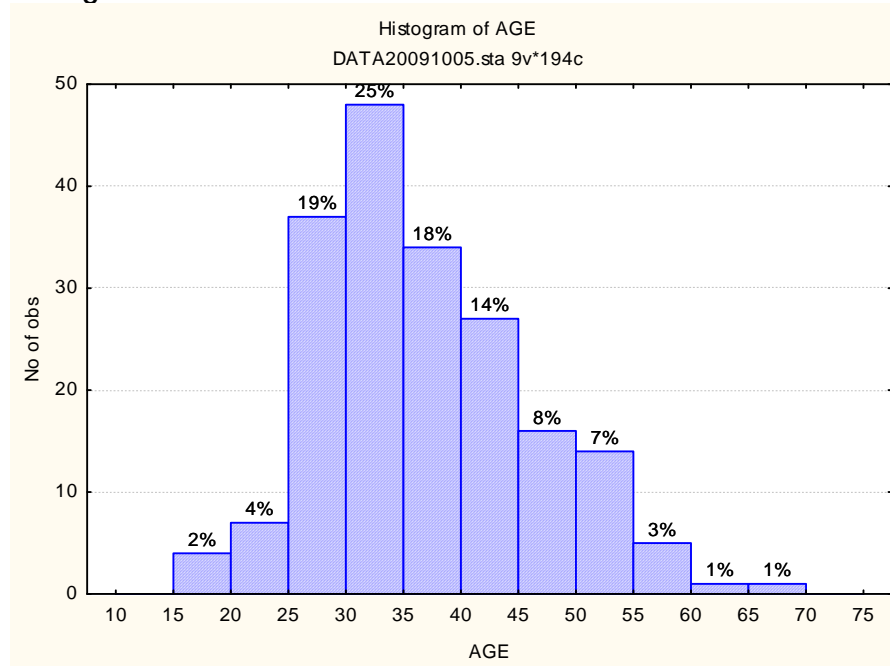
Effect	Descriptive Statistics (DATA20091005.sta)						
	Level of Factor	N	BMI DIFF Mean	BMI DIFF Std.Dev.	BMI DIFF Std.Err	BMI DIFF -95.00%	BMI DIFF +95.00%
Total		194	2.395876	3.010462	0.216139	1.969579	2.822173
OI	N	93	1.925806	2.826694	0.293114	1.343656	2.507957
OI	Y	101	2.828713	3.121805	0.310631	2.212429	3.444996

Table 5.4 shows the number of patients that had opportunistic infections and those that did not. Out of the total of 194 patients 101 had opportunistic infections, which represent 52% of individuals, and 93 had no opportunistic infections, which is 48% of individuals. This is also shown in the histogram in figure 5.11.

From the descriptive statistic in table 5.4, the mean of the BMI difference for those that had opportunistic infections was 2.83 and for those who did not have opportunistic infections was 1.92. This shows that those patients that had opportunistic infections at the beginning of the study period made significant recovery after they received treatment for these infections in addition to ART. The mean BMI difference for those that did not have opportunistic infections was lower. This indicates that opportunistic infections had a significant influence on the difference between the initial and the end BMI.

Figure 5.13

Histogram of AGE



More than 50% of individuals were less than 40 years of age. Most of them, 25%, were between the age of 30 and 35 years. 19% were between 25 and 30 years. And 6% were below 25 years. See figure 5.13 above.

Figure 5.14
Scatterplot of BMI DIFF against AGE All Groups

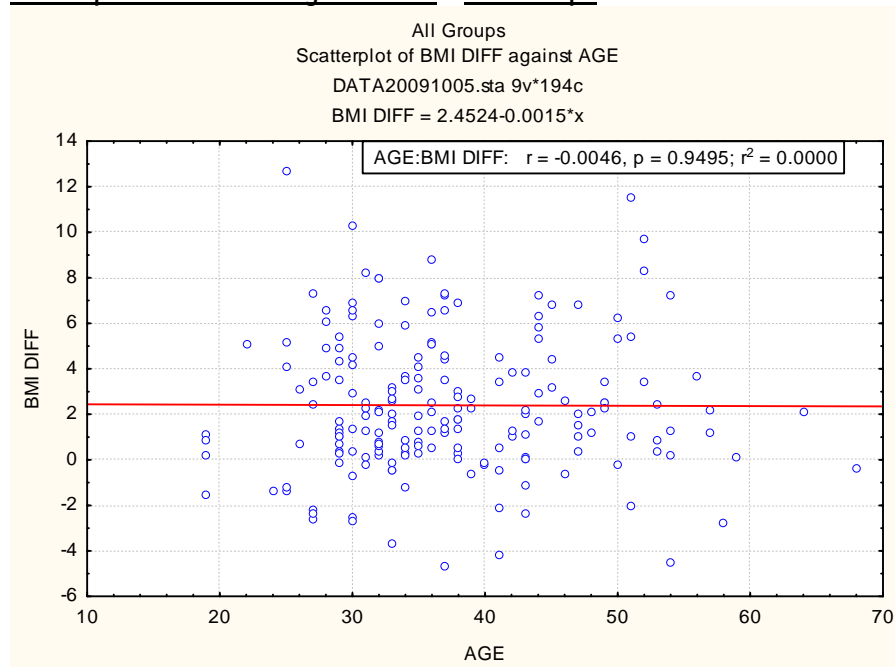


Figure 5.14 represents the correlation analysis done for all age groups did not show any significant relationship between age and BMI difference, $r = 0.04$, $p = 0.95$, $p < 0.05$. This means that age had no significant influence on BMI difference for all the groups.

Figure 5.15
Scatterplot of BMI DIFF against AGE

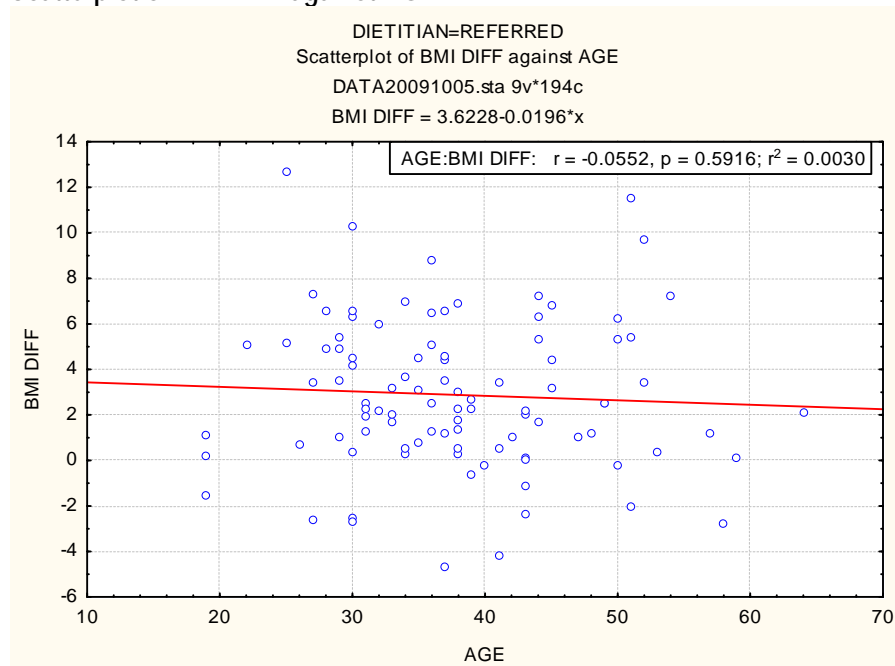


Figure 5.15 shows that there was no significant relationship between age and BMI difference for the group that was referred to the dietitian, $r = 0.05$, $p = 0.59$, $p < 0.05$.

Figure 5.16
Scatterplot of BMI DIFF against AGE

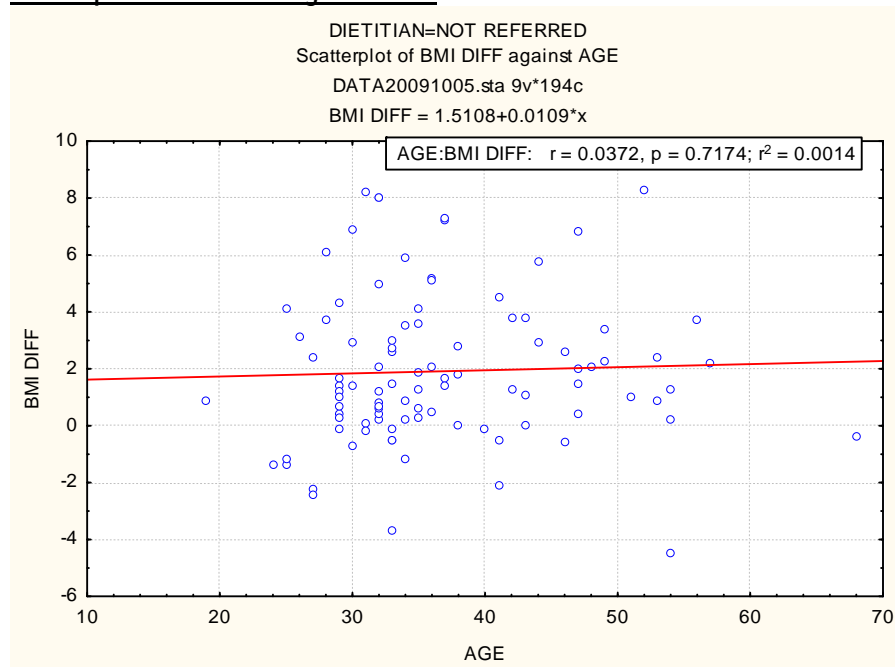
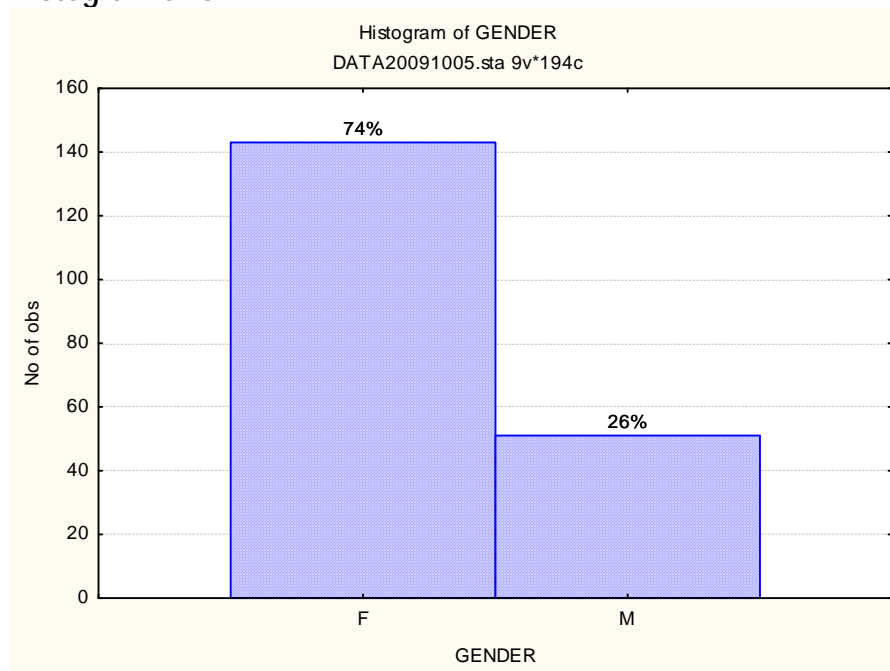


Figure 5.16 shows that there was no significant relationship between age and BMI difference by the group that was not referred to the dietitian, $r = 0.04$, $p = 0.72$, $p < 0.05$.

Figure 5.17
Histogram of GENDER



In the study there were 74% females and 26% males as show in figure 5.17 above.

Table 5.5

All Groups

Univariate Tests of Significance for BMI DIFF (DATA20091005.sta)

All Groups Univariate Tests of Significance for BMI DIFF (DATA20091005.sta) Sigma-restricted parameterization Effective hypothesis decomposition					
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	799.442	1	799.4423	88.02689	0.000000
GENDER	5.432	1	5.4318	0.59809	0.440257
Error	1743.705	192	9.0818		

Table 5.5 shows the computed influence of gender on BM difference. There was no significant influence of gender on BMI difference for all the groups, $F = 0.6$, $p = 0.44$, $p < 0.05$.

The analysis was also presented in terms of confidence intervals for BMI difference at each gender for all groups. There was no significant influence of gender on BMI difference, $F(1, 192) = 0.6$, $p = 0.44$, $p < 0.05$. See figure 5.18 below.

Figure 5.18

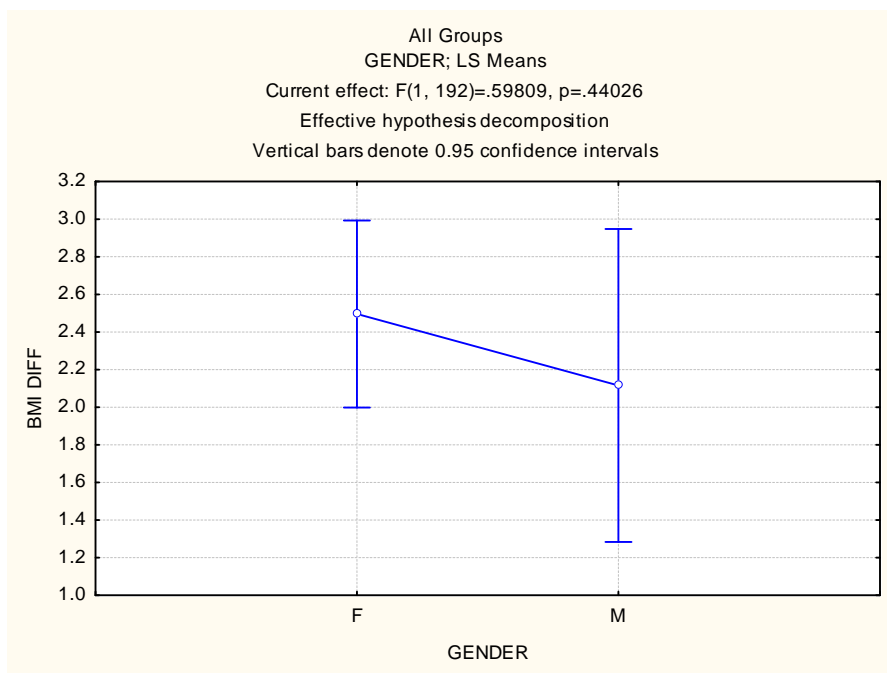
GENDER; LS Means

Table 5.6

Univariate Tests of Significance for BMI DIFF (DATA20091005.sta)

DIETITIAN=REFERRED Univariate Tests of Significance for BMI DIFF (DATA20091005.sta) Sigma-restricted parameterization Effective hypothesis decomposition					
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	567.809	1	567.8086	51.96586	0.000000
GENDER	7.775	1	7.7748	0.71155	0.401050
Error	1038.024	95	10.9266		

Table 5.6 shows that there was no influence of gender on BMI difference in those that were referred to the dietician $F(1, 95) = 0.71$, $p = 0.40$, $p < 0.05$.

Figure 5.19

GENDER; LS Means

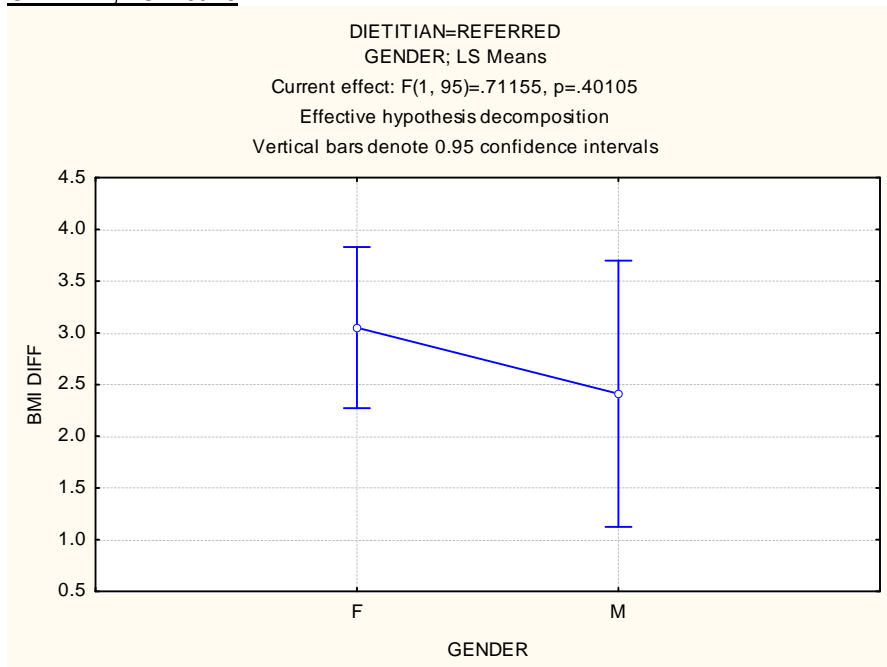


Figure 5.19 shows that gender has no significant influence on BMI difference in those that were referred to the dietician, $F(1, 95) = 0.71$, $p = 0.40$, $p < 0.05$.

Table 5.7

Univariate Tests of Significance for BMI DIFF (DATA20091005.sta)

DIETITIAN=NOT REFERRED Univariate Tests of Significance for BMI DIFF (DATA20091005.sta) Sigma-restricted parameterization Effective hypothesis decomposition					
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	261.8745	1	261.8745	37.83058	0.000000
GENDER	0.3669	1	0.3669	0.05300	0.818415
Error	657.6183	95	6.9223		

Table 5.7 shows the computed F and p values for those that were not referred to the dietitian. From F and p values obtained it is shown that there was no significant influence of gender on the BMI difference for those that were not referred to the dietitian, $F = 0.05$, $p = 0.82$, $p < 0.05$.

Figure 5.20

GENDER; LS Means

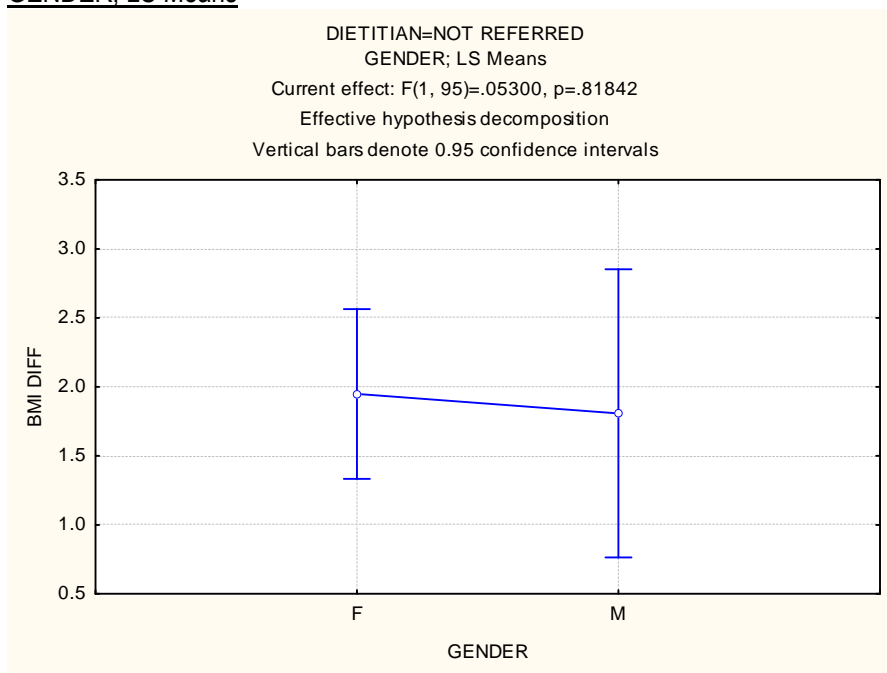
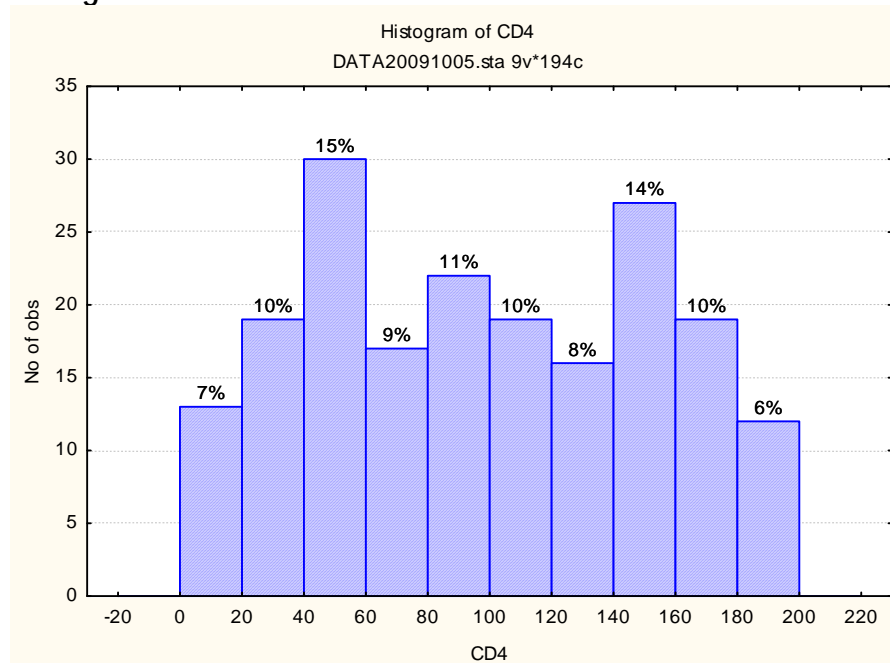


Figure 5.20 shows that gender did not have a significant influence on BMI difference in those that were not referred to the dietitian, $F(1, 95) = 0.05$, $p = 0.82$, $p < 0.05$.

Figure 5.21
Histogram of CD4

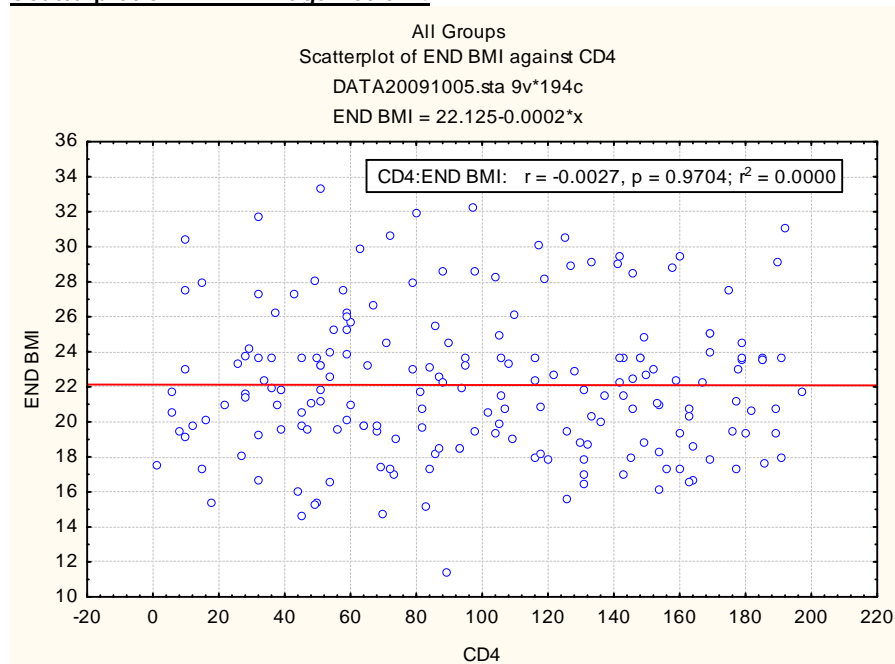


All the patients in the study had CD4 counts less than 200. 52% of individuals had CD4 counts of less than 100 and 32% had CD4 count less than 60. See figure 5.21 above.

Figure 5.22

All Groups

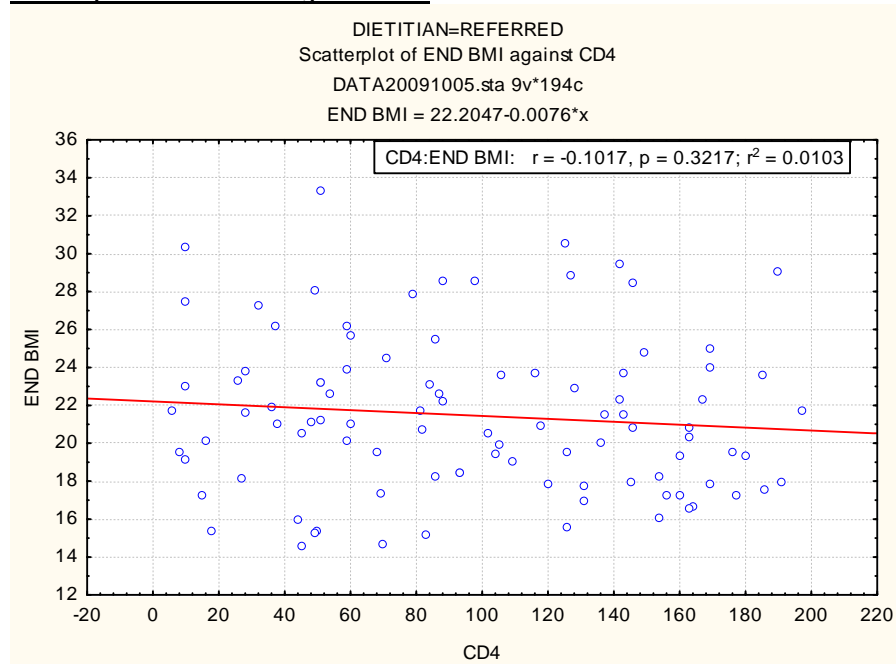
Scatterplot of END BMI against CD4



The influence of CD4 count on end BMI was analysed using the Spearman rank correlation analysis. For all groups there was no correlation between CD4 count and end BMI $r = 0.003$, $p = 0.97$, $p < 0.05$. This is shown in figure 5.22 above.

Figure 5.23

Scatterplot of END BMI against CD4



Those that were referred to the dietitian did not show any significant correlation between the baseline CD4 count and the end BMI, $r = 0.10$, $p = 0.32$, $p < 0.05$. See figure 5.23 above.

Figure 5.24

Scatterplot of END BMI against CD4

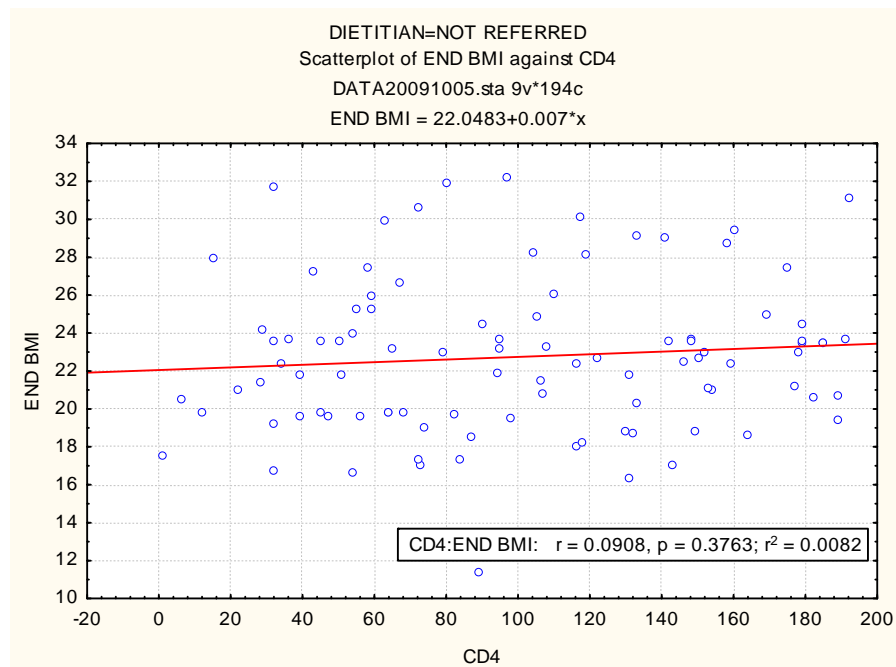


Figure 5.24 shows that there was no correlation between the baseline CD4 count and the end BMI in those patients that were not referred to the dietitian, $r = 0.09$, $p = 0.38$, $p < 0.05$.

6. Discussion

The results of the study showed that patients that were initiated on ART and referred to the dietician have a significant improvement in their nutrition status than those that were initiated on ART but not referred. This informs us that in treating PLWHA with antiretroviral therapy alone is not adequate. These patients also require good nutrition.

There were more females than males in the study. This is similar to the South African HIV prevalence information published by the Human Sciences Research Council (HSRC) in 2005. This shows that there is need to educate men about testing for HIV and seeking medical assistance when needed. This is important because most of the workforce in South Africa is made of men. If most of the men are ill they will be unable to be productive this in turn will lead to poverty and poor nutrition leading to high rate of morbidity and mortality in the communities they live.

In the study period January to December 2008, not every patient was initiated on ART at the same time. Some patients started treatment at the beginning of the study period in January and some in the middle while others towards the end of the period. This difference in the length of time the patients were on treatment could have had an influence on the nutrition outcome of individuals at the end of the study period. The patients that were initiated on ART at the beginning of the study period were likely to have visited the dietician more times than those that were initiated towards the end. Those that were started on ART at the beginning of the period could have also benefited from the treatment itself for a longer period of time. This could have positively affected the end BMI of these patients. It would be appropriate if all the individuals in the study were initiated on ART at about the same time so that they have the same duration of treatment at the end of the study.

In the study it was observed that there were some patients that were referred to the dietician but did not show any improvement in their BMI. Some of them even had lower BMI at end of the period. This could have been due to the fact that most of the patients were referred to the dietician with no supporter for example an adherence partner, a friend or a family member.

These patients did not have the encouragement to adhere to the prescribed diet and instructions issued by the dietician. These patients whose BMI did not improve or became lower were, however, in the minority.

A small number of patients were referred to a dietician in the study. Because of this small number it was difficult to randomly select those who qualified to be included in the study and then match them with those that were not referred. This limitation of numbers might have introduced some bias in the study. Data in the study were not normally distributed. This can also be attributed to the small sample size. Because the data were not normally distributed non-parametric statistical tests for example the Mann-Whitney test, were appropriate. However, parametric statistical tests such as the ANOVA and the student t-test were also used. The null hypothesis was rejected by both the parametric and non-parametric statistical tests.

Patients in the study were selected from one wellness clinic. If more wellness clinics from surrounding hospitals were included larger numbers of patients were going to be obtained providing the study with a large sample size that would have been more representative of the population. This would also have reduced the possibilities of bias in the study.

To have a large sample size would be ideal, however, to conduct the study in different wellness clinics in different hospitals most of which are far apart would require a lot more financial and human resources. These resources were limited in this study. Due to the small number of patients in the study the data were not normally distributed. As seen in the normal probability plots and histograms in the data analysis.

In the study it was also noted that the age groups ranged from 15 to 68 years. Majority of the patients were in the 30-35 years age group. This is different from the South African HIV prevalence information published by the HSRC in 2005 which showed that majority of the cases of HIV were between the ages of 25-29 years with a higher prevalence among women. This difference can be attributed to the small sample size.

6.1. Recommendations

- As it has been noted, there were fewer men than women that were enrolled in the study. This is because there are more women attending the wellness clinic. It is therefore recommended that strategies are developed and programmes put in place that are targeted at men encouraging them to go for voluntary counselling and testing for HIV and to seek medical assistance when required. This will assist in prevention efforts against the spread of HIV infections and will ensure that men live healthy and productive lives.
- In the study it has been determined that patients initiated on ART benefit from good nutrition, therefore, it is recommended that all health care institutions taking care of PLWHA should have a full time dietician employed.
- From the results of the study it has been proved that nutrition is important for PLWHA who are started on antiretroviral therapy, it is, therefore, recommended that health care workers ensure that all patients initiated on ART are referred to a dietician regardless of their initial CD4 count, body weight or presence or absence of opportunistic infections.
- The study should be repeated with a large population and at more than one HIV site. This will require more resources including financial and human resources. The large sample size will closely represent the population in which the study will be conducted. To repeat the study with a large sample size is recommended. It is also recommended that patients included in the study should start antiretroviral therapy at about the same time.
- The results of this study should apply to people in the workplace as much as they do to this rural setting because some of the workers in the workplace come from these rural communities and are likely to be affected with HIV/AIDS in much the same way.

7. Conclusion

In summary, it can be said that nutrition is very important in patients with HIV/AIDS. The diet for these patients should be adequate and should contain the necessary macro and micronutrients. A qualified dietitian who is a member of the health care worker team taking care of PLWHA should prescribe the diet.

Training of more dietitians is important. It is a fact that there are few dietitians per population in Southern Africa for example in Botswana there are 24 dietitians for the whole country of more than 1 million people, 4 in Lesotho and inadequate numbers in South Africa to cover all the HIV sites. (Duncan, A, 2007). Training nutrition specialist nurses and dietetic assistants is also recommended in order to alleviate the shortage.

The statistical analysis from this research showed that referring patients to a dietitian for diet prescription and nutrition advice assist in improving the patient's health outcome as shown in the improvement in BMI. It can be concluded that antiretroviral therapy and good nutrition are important in the comprehensive management of patients with HIV/AIDS. All patients initiated on ART should be referred to a dietitian. It is necessary to refer all the PLWHA in the workplace who require ART to a dietitian. This will improve their health outcome. A workforce in good health will reduce the amount of absenteeism due to illness, and the cost of health care. A healthy workforce will be productive increasing profitability of the company they work for and will alleviate poverty in their families and communities the workers come from.

The results of the study show that antiretroviral therapy alone is not adequate and advice of a dietitian is vital - diet and nutrition assessment is an essential part of comprehensive HIV care both before and during antiretroviral therapy.

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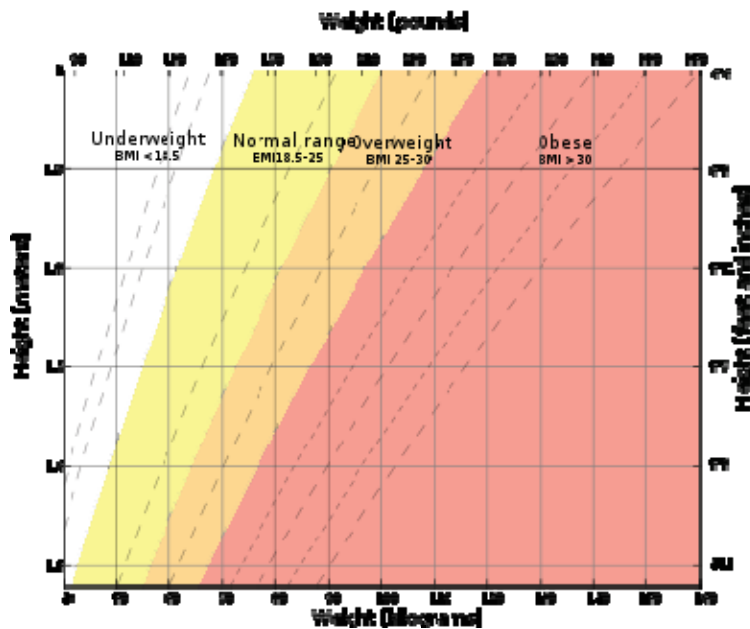
School of Economics. University of Cape Town. South Africa.

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APPENDICES

Appendix A



A graph of body mass index is shown above. The dashed lines represent subdivisions within a major class. For instance the "Underweight" classification is further divided into "severe," "moderate," and "mild" subclasses. Based on [World Health Organization](#) data [here](#)

Appendix B

DATA COLLECTION SHEET

	1	2	3	4	5	6	7
INITIAL BMI							
BASELINE CD4 COUNT							
OPPORTUNISTIC INFECTIONS							
REFERRAL To DIETICIAN							
END OF PERIOD BMI							
AGE							
SEX							

Appendix C

GELUKSPAN DISTRICT HOSPITAL – WELLNESS CLINIC

ARV INITIATION – INITIAL CONSULTATION

Name	Age
Health Number	Sex
Date	

SOCIAL HISTORY:

Occupation / Grant

Smoking

Alcohol

HIV HISTORY:

First knew status: / / (Date)

Background to discovery:		
1. Insurance		
2. Request		
3. Clinicians suggestion		
4. ANC Clinic		
	Date	Amount
Latest CD4 count		
Viral load		

FAMILY HISTORY OF HIV:

Condoms	Yes	No
Contraception	Yes	No
Disclosure	Yes	No
Family Status:	+ve	-ve
Partner		
Child1		
Child2		
Child 3		
Child4		

PREVIOUS ARV TREATMENT

Yes		No
If yes, date started		If stopped, date stopped
Drugs:		Reason for stopping:
1		1. Cost
2		2. Non adherence
3		3. Other
Nevirapine during pregnancy:		
Yes	No	

TB HISTORY:

TB self: Yes / No

If yes: Date started treatment_____

Date ended treatment _____
 TB family: Yes / No
 If yes: Relationship:
 Date started treatment _____
 Date ended treatment _____

If TB history, diagnosed by:

Sputum	
LNA gland	
Suspicious x-ray	
Other	
Unknown	

Past medical history/ surgical history of note

History of adverse drug reaction / allergies

Current medication

CURRENT HIV SYMPTOMS

Symptom		Duration
Cough		
Sore feet		
Mouth ulcers		
Genital lesions		
Rash		
Diarrhea		

OTHER COMPLAINTS

GENERAL IMPRESSION

Well	
Thin	
Moderate wasting	
Severe wasting	

MOBILITY

Walking	
Wheel Chair	
Stretcher	

BASIC MEASUREMENTS

Weight	
Height	
Temperature	
Pulse	
BP	

PHYSICAL EXAMINATION

Colour
 Glands
 Skin lesions
 Chest
 CVS
 Abdomen
 Genitalia
 Mouth
 CNS
 Fungi

Peripheries: Lower limbs

	Right	Left
Light touch		
Pin prick		
Vibration sense		
Reflex – knee		
Reflex - ankle		

BASELINE PROCEDURES:

1. CXR
2. LFT's
3. FBC
4. Adherence counselling

RVD WHO CLASSIFICATION:

Stage_____

ARV DRUGS:

Name	Dosage

RVD associates:

Bactrim	
Vit B Co	
Vit C	

OTHER DRUGS

INSTRUCTIONS TO NURSES

Tests to be done	
Date results to be collected	
Alert for	

Appendix D

REFERRAL LETTER FOR DIETICIAN

NAME OF THE WARD

NAME OF THE PATIENT

FILE NUMBER

DIAGNOSIS OF THE PATIENT

AGE

GENDER

ADMISSION WEIGHT

HEIGHT

NAME OF THE DOCTOR

FOR OFFICE USE ONLY

NUTRITION INTERVENTION

Appendix E

The South African National Guidelines on Nutrition for people living with HIV, AIDS, TB, and other debilitating conditions classifies malnutrition in adults by BMI as follows:

BMI Cut off points	Interpretation
<18.5	Underweight
19 – 24	Normal
25 – 29	Overweight
30 – 39	Obesity
>40	Severe Overweight